3. Subbasin Assessment – Pollutant Source Inventory

This section of the SBA provides available information concerning potential sediment sources. Sediment sources in the South Fork Payette River Subbasin include natural sediment delivery and sediment delivered to stream channels due to human activities, primarily from forest roads.

3.1 Sources of Pollutants of Concern

Sources of sediment to the South Fork Payette River can be categorized into point sources and nonpoint sources. Point sources are defined as discrete, readily identified points of discharge to receiving waters. Examples of point sources include pipes or other outfall structures from industries and municipalities. Nonpoint sources of pollution are characterized by having diffuse or indistinguishable points of discharge spread across large areas or across entire landscapes.

Point Sources

No National Pollution Discharge Elimination System point sources are known to exist in the South Fork Payette River Subbasin.

Nonpoint Sources

The land use of the South Fork Payette River Subbasin is dominated by forest (Figure 12). Based on acreage estimates from IDWR spatial data, forest land uses make up 99.9% of the subbasin (IDWR 1990). The remaining 0.1% of land is gravity and sprinkler irrigation land, range, urban, and open water. With the subbasin dominated by forest, the primary potential sources of sediment in the subbasin are from natural background, stochastic weather events, and roads for timber harvest and recreation.

Idaho forest practices water quality audits have shown that roads, the most persistent source of forestland disturbances, are a primary source of human-induced sediment in waterbodies (Bauer et al. 1985, Harvey et al. 1989, Hoelscher et al. 1993, Zaroban et al. 1997).

The road cuts along Highway 21 between the Grandjean turnoff and Banner summit are another source of sediment in the subbasin. During stochastic precipitation events, erosion from the road cuts causes high suspended sediment levels in Canyon Creek, which in turn causes the South Fork Payette River to become extremely turbid for two to three days at a time. DEQ intends to work with the Idaho Department of Transportation to explore ways to mitigate these sediment sources.

Horn, Wash, Chapman and Smokey Creeks are the three watersheds that have been found to be impacted by fire and storm events. DEQ will also coordinate with the Boise National Forest and continue to monitor these creeks for improvements in overall stream health.

Pollutant Transport

Flowing water transports sediment by solution, suspension, and bed load (Hunt 1974). The capacity of a stream to transport sediment is affected by velocity, manner of stream flow (laminar flow and turbulent flow), roughness of the streambed, stream energy (stream volume times its fall), and antecedent sediment load (Hunt 1974).

The South Fork Payette River and the smaller tributaries have relatively high stream velocities, considerable amounts of turbulent flow, and high stream energy. These factors combine to make the South Fork Payette River and its tributaries predominantly a sediment transporting stream. Wendt et al. (1973a) reported that the South Fork Payette River and its tributaries are high energy streams capable of flushing sediment through the system rather rapidly.

Estimation and Prioritization of Sediment Sources

The South Fork Payette River Subbasin is almost entirely forested and the land uses in the subbasin are almost entirely forest activities. In areas of forest activities, roads are the primary human-induced source of stream sediment (Megahan and Kidd 1972, Bauer et al. 1985, Harvey et al. 1989, Hoelscher et al. 1993, Zaroban et al. 1997).

Even though SCC target exceedences were not noted during low and normal flow years, exceedences were noted during high flow years. While higher that average SSC levels are to be expected in high flow years, management actions should still be taken to minimize the amount of anthropogenic sediment delivered to the river.

To help facilitate such management actions, the 12-digit (HUC6) watersheds most likely to contribute sediment to the South Fork Payette River were ranked and prioritized according to geomorphic risk. This scheme provides a prioritization mechanism for land managers. The evaluation follows the rationale of Geier and Loggy (1995) and Fitzgerald et al. (1999). Factors considered in the evaluation include the inherent surface erosion hazard of the land types, gradient (overall rate of elevation change in feet per mile) for the mainstem stream, road density (miles per square mile), and percent of the streambed surface covered with fine-grained (0.25 inch diameter or less) sediment. Each of these factors is described below in more detail.

Land Type Erosion Hazard

The USFS has classified and mapped the land they manage into land types. Each land type has received an erosion and stability hazard rating. Erosion and stability hazard ratings for land types contained in the South Fork Payette River Subbasin were obtained from Wendt et al. (1973a, 1973b) and Larson and Rahm (1972). Erosion hazard is rated on a 1 to 5 scale. Rating definitions (Larson and Rahm 1972) are as follows:

- 1—very low, no appreciable hazard of erosion
- 2—low, sufficiently resistant to erosion to permit exposure of bare soil under minimal precautionary restrictions
- 3—moderate, sufficiently resistant to erosion to permit limited and temporary exposure of bare soil during development or use
- 4—high, unprotected bare soil will erode sufficiently to severely damage productive capacity or will yield high volumes of sediment
- 5—very high, unprotected bare soil will erode sufficiently to severely and permanently damage the productive capacity of the soil or will yield excessively high volumes of sediment

Using spatial data, each HUC6 watershed in the South Fork Payette River Subbasin was assigned a weighted erosion hazard rating. The weighting coefficient was the proportion of the HUC6 watershed surface area represented by each land type.

Gradient

The rate of elevation change or gradient (feet per mile) was calculated for the mainstem stream in each HUC6 watershed by dividing the difference between the maximum and minimum elevations by the length of the stream segment. Estimates of the stream segment boundaries and stream segment length were taken from the IDWR (1996) 1:100,000 scale hydrography data layer. The HUC6 watershed boundaries were obtained from the IDWR (2000) watersheds 4th, 5th, and 6th spatial data layer. Gradient ratings were assigned as follows:

- 1—greater than 400 feet per mile
- 2—301-400 feet per mile
- 3—201-300 feet per mile
- 4—100-200 feet per mile
- 5—less than 100 feet per mile

Road Density

The density of roads (miles per square mile) in the South Fork Payette River Subbasin was calculated by dividing the miles of road present in each HUC6 watershed by the area of the HUC6 watershed (square miles). The miles of road present were obtained from the Boise National Forest road data layer (Boise National Forest 1995). Road density ratings were assigned as follows:

- 1—0.5 miles per square mile
- 2—0.51-1.5 miles per square mile
- 3—1.51-2.5 miles per square mile
- 4—2.51-3.5 miles per square mile
- 5—greater than 3.5 miles per square mile

Percent Surface Fines

The percentage of the streambed surface covered by fine sediment (0.25 inch particle size diameter or less) was estimated from Wolman pebble count (Wolman 1954) data collected by the Boise National Forest and DEQ. The average percentage of fine-grained sediment for all samples collected within a given HUC6 watershed was calculated. HUC6 watersheds for which no pebble count data are available were assigned the average of their erosion hazard, fall and road density ratings. Fine sediment ratings for HUC6 watersheds with pebble count data were assigned as follows:

- 1—0-20%
- 2—21-30%
- 3—31-40%
- 4—41-50%
- 5—greater than 50%

The geomorphic risk ratings for each HUC6 watershed are summarized in Table 52. The table is ordered with the overall geomorphic risk scores in descending order. Table 53 summarizes the watershed with impaired water bodies.

Table 52. Summary of erosion hazard, gradient, roads, fine-grained sediment and overall geomorphic risk score for HUC6 watersheds.

HUC6 Name	Erosion	Gradient	Roads	Fines	Erosion Hazard Score	Gradient Score	Road Score	Fine Grained Sediment Score	Risk Score
DEADWOOD RESERVOIR	3.85	29	0.88	53	4	5	2	5	16
BLUEJAY	4.37	45	0.8		5	5	2	4	16
DANSKIN POORMAN	3.51	12	1.81		3	5	3	4	15
HOLE IN THE WALL	3.83	42	0.7		4	5	2	4	15
WARM SPRINGS	3.36	142	2.61	45	2	4	4	4	14
NINEMILE	3.86	71	0.88	31	4	5	2	3	14
ALDER CREEK	3.72	264	1.4	67	3	3	2	5	13
UPPER DEADWOOD	3.59	91	0.3	45	3	5	1	4	13
LOWER DEADWOOD	3.96	66	0.32	40	4	5	1	3	13
LOWER CLEAR CREEK	3.53	138	2.47	36	3	4	3	3	13
ROCK CREEK	3.64	354	4.04	34	3	2	5	3	13
KIRKHAM	3.61	31	2.4	22	3	5	3	2	13
JACKSON FENCE	3.75	35	0.71	27	3	5	2	2	12
BEAR CAMP	3.84	47	0.5	24	4	5	1	2	12
WOLF	3.49	60	1.04		2	5	2	3	12
DEER CREEK	3.41	167	0.97	40	2	4	2	3	11
WHITEHAWK	3.55	309	1.62	33	3	2	3	3	11
LOWER SF PAYETTE	3.58	40	0.35	27	3	5	1	2	11
GRANDJEAN	3.47	45	0.35		2	5	1	3	11
TENMILE CREEK	3.94	312	0.13	33	4	2	1	3	10
BIG PINE CREEK	4.22	427	1.14	30	5	1	2	2	10
SAMS LORENZO	3.48	60	0.15	29	2	5	1	2	10
UPPER CLEAR CREEK	3.61	222	0.73	28	3	3	2	2	10

Table 52 (Cont.). Summary of erosion hazard, gradient, roads, fine-grained sediment and overall geomorphic risk score for HUC6 watersheds.

WARM SPRING	3.62	115	0.07	21	3	4	1	2	10
UPPER CANYON	4.09	243	0.25	18	5	3	1	1	10
EIGHTMILE CREEK	3.96	314	0.04	25	4	2	1	2	9
LOWER CANYON	3.66	179	0.41	10	3	4	1	1	9
SCOTT CREEK	3.56	347	0.43	25	3	2	1	2	8
MINK LAKE	3.38	108	0	15	2	4	1	1	8
BULL TROUT	3.62	351	0.06		3	2	1	2	8
FIVEMILE CREEK	3.57	422	0.14	22	3	1	1	2	7
PINCHOT FALL	2.31	211	0		1	3	1	2	7
BARON CREEK	3.66	429	0	13	3	1	1	1	6
UPPER SF PAYETTE RIVER	2.54	330	0		1	2	1	1	5
GOAT CREEK	3.17	456	0	13	1	1	1	1	4

Table 53. Summary of erosion hazard, gradient, roads, fine-grained sediment and overall geomorphic risk score for Impaired Water Bodies.

HUC6 Water Body Name	Erosion	Gradient	Roads	Fines	Erosion Hazard Score	Gradient Score	Road Score	Fine Grained Sediment Score	Risk Score
BLUEJAY Chapman Creek	4.37	45	0.8		5	5	2	4	16
DANSKIN POORMAN Wash Creek and Horn Creek	3.51	12	1.81		3	5	3	4	15
KIRKHAM Smokey Creek	3.61	31	2.4	22	3	5	3	2	13

Fires and Landslides

The geomorphic risk evaluation described in the previous section is useful for identifying HUC6 watersheds in the South Fork Payette River Subbasin with the greatest likelihood of yielding fine sediment on a long-term basis. However, this evaluation does not account for short-term stochastic events that can produce or contribute to excessive erosion of fine-grained sediment. In the South Fork Payette River Subbasin, fires (Figure 42) and rain-on-snow runoff events have contributed to landslides and debris torrents (Figure 43) that yield large amounts of fine-grained sediment. Two events are particularly noteworthy within the scope of this subbasin assessment: The Lowman fire of 1989 and the rain-on-snow event of late December 1996 and early January 1997 have combined to produce a large number of landslides in the Hole-in-the-Wall, Jackson-Fence, and Kirkham HUC6 watersheds (Figure 47). Additional landslides and debris torrents have occurred subsequent to 1997, but data to describe these events are not yet available.

Comparison of similar watersheds in the Idaho batholith

As discussed previously, fires, rain on snow events and summer thunderstorms have had a significant impact on the South Fork Payette River watershed over the last 15-20 years. These types of impacts are also common in other watersheds with similar geology, elevation and slope. Examples of similar situations exist in the Middle Fork Salmon River watershed where a vast majority of the area is located in wilderness. Figures 42 through 45 illustrate the types of events that can occur in unmanaged watersheds like the Middle Fork Salmon River. Figures 42 and 43 show blowouts from two unburned (in recent time) tributaries. Figures 44 and 45 show the results of a blowout from a burned area. These debris slides are on Idaho batholithic granitic soils and occurred after heavy stochastic rain events similar to those that occur in the South Fork Payette River drainage typically during the summer months, but occasionally in fall or winter.

Figure 42. Jack Creek blowout – Middle Fork Salmon River, September 17, 2002

The debris at Jack Creek came from the west side just upstream of Loon Creek from an upland type slope dotted with some sagebrush and grasses and forbs.

Figure 43. Orelano Creek blowout – Middle Fork Salmon River, September 2002

Orelano Creek is a relatively small drainage, very steep, heavily forested.

Figure 44. Haystack Rapid – Middle Fork Salmon River, September 19, 2002 (above)

Figure 45. Haystack Rapid – Middle Fork Salmon River, 2003 (below) after Bernard Creek blowout

Source Summary

Natural background, landslides, and roads are the primary sources of fine-grained sediment to the South Fork Payette River. Forest roads are the primary controllable source. Once in the river, fine-grained sediment is readily transported out of the subbasin due to high stream gradient and velocity.

An estimate of HUC6 watersheds most likely to contribute fine-grained sediment to the South Fork Payette River is given in Table 52. Using this work as a baseline, DEQ recommends further characterizing the sediment loads by determining the relative quantity of fine-grained sediment contributed from natural background, landslides, roads, and any other potential sources. These quantities may be established by the following methods:

- conducting a road inventory
- updating the Boise National Forest road spatial data layer
- accounting for and quantifying the amount of sediment delivered to the river from landslides that have occurred since 1997
- generating a BOISED model (Potyondy et al. 1991) prediction of sediment yield
- surveying the limited non-forest lands and timber harvest in the subbasin to document any sediment yield

Much of this information is already being collected. The Boise National Forest and EPA coordinated a road inventory in the subbasin in 2004. The Boise National Forest is in the process of updating the spatial data layer for roads and assessing landslides.

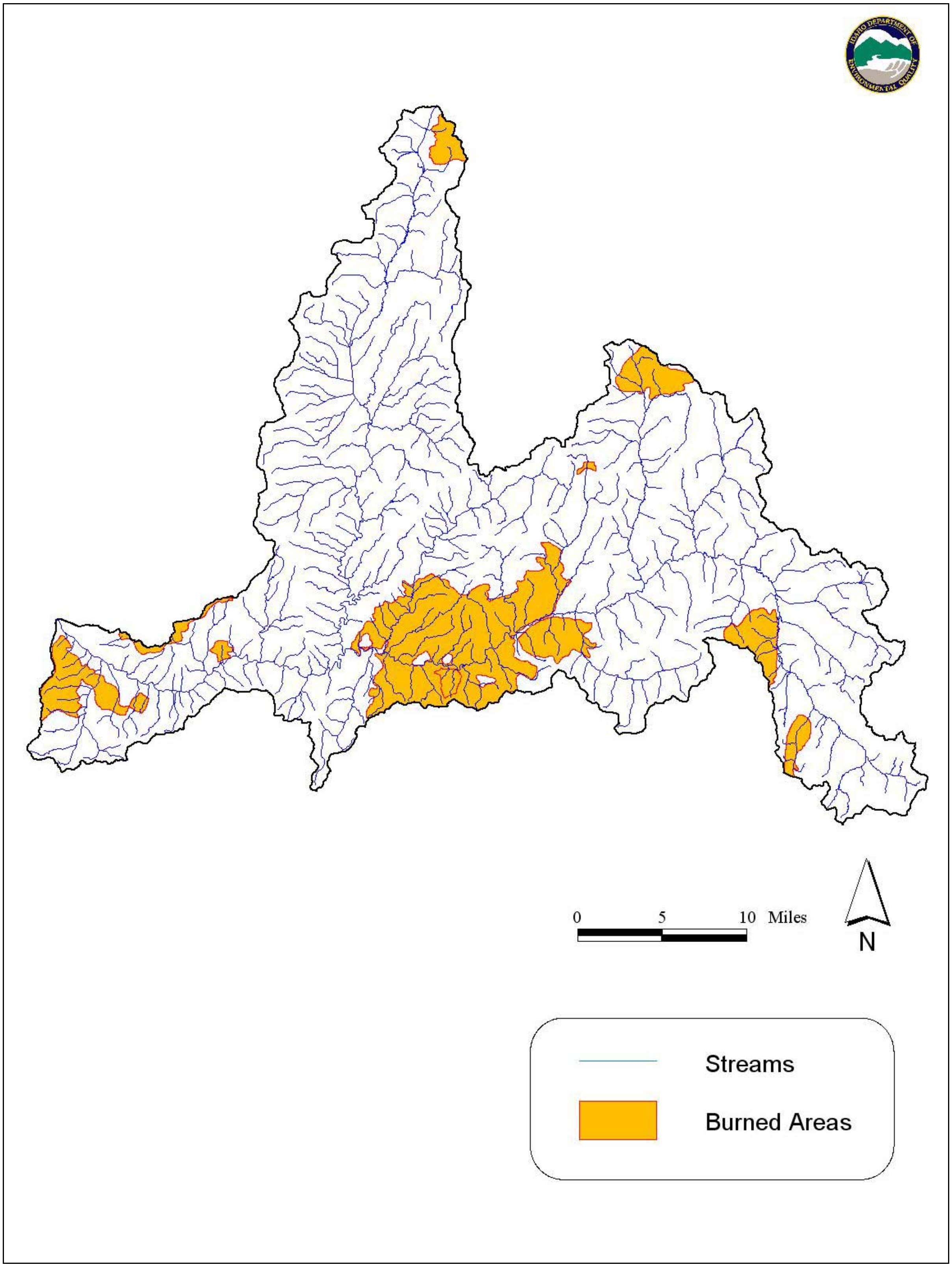

Figure 46. Fifty Year Fire Occurrence in the South Fork Payette River Subbasin.

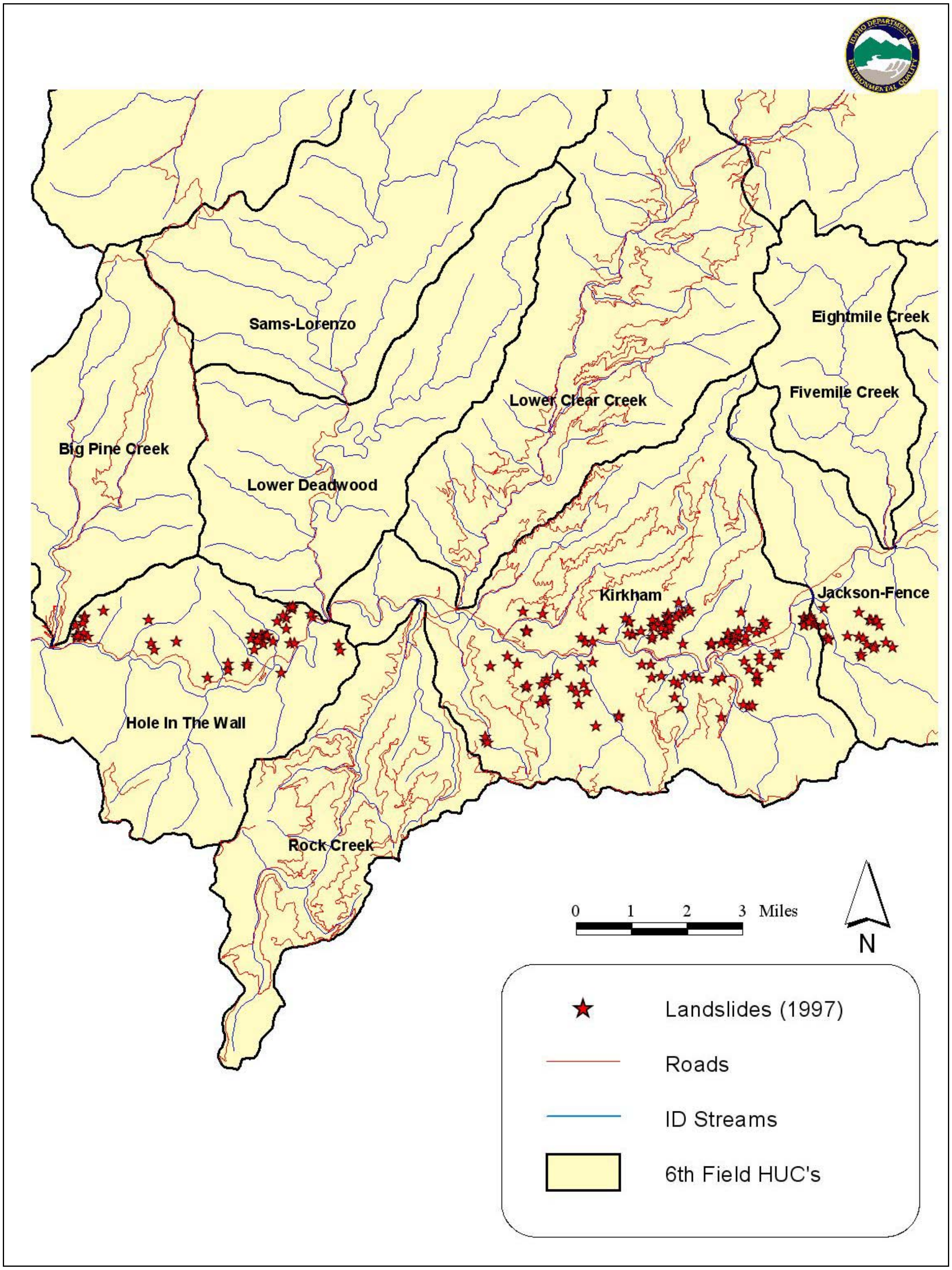

Figure47. Locations of Significant 1995 Landslides in the South Fork Payette River Subbasin.